

III. "On the Thermal Effects of Fluids in Motion." By J. P. JOULE, LL.D., F.R.S., and Professor W. THOMSON, LL.D., F.R.S. Received May 9, 1860.

In our paper published in the Philosophical Transactions for 1854, we explained the object of our experiments to ascertain the difference of temperature between the high- and low-pressure sides of a porous plug through which elastic fluids were forced. Our experiments were then limited to air and carbonic acid. With new apparatus, obtained by an allotment from the Government grant, we have been able to determine the thermal effect with various other elastic fluids. The following is a brief summary of our principal results at a low temperature (about 7° Cent.).

| Elastic fluid. | | | Thermal effect per 100 lbs. pressure on the square inch, in degrees Centigrade. |
|----------------|----------|--------------------------|--|
| | Air. | | 1·6 Cold. |
| 3·9 | Air | +96·1 Hydrogen | 0·116 Heat. |
| 7·9 | Air | +92·1 Nitrogen | 1·772 Cold. |
| 5·1 | Air | +94·9 Oxygen | 1·936 Cold. |
| 3·5 | Air | +96·5 Carbonic acid .. | 8·19 Cold. |
| 58·3 | Air | +41·7 Hydrogen | 0·7 Cold. |
| 62·5 | Air | +37·5 Carbonic acid .. | 3·486 Cold. |
| 54·6 | Nitrogen | +45·4 Oxygen | 1·696 Cold. |
| 4·23 | Air | { +46·47 Hydrogen .. } | 2·848 Cold. |
| | | { +49·3 Carbonic acid } | |

Further experiments are being made at high temperatures, which show, in the gases in which a cooling effect is found, a decrease of this effect, and an increase of the heating effect in hydrogen. The results at present arrived at indicate invariably that a mixture of gases gives a smaller cooling effect than that deduced from the average of the effects of the pure gases.